

May 23, 2001

MEMORANDUM:

SUBJECT: Lindane (009001): Dietary Risk and Exposure Estimate For Lindane Through Subsistence Diets for Indigenous People of Alaska. DP Barcode # D273800. Reregistration Case 0315. MRID No. none.

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INTRODUCTION:

The occurrence of organochlorine contaminants in the Arctic has been documented in several studies. A variety of organochlorine contaminants including lindane has been found in terrestrial, freshwater, and marine habitats. This contamination is primarily the result of long range continental transport through the movement of the air and ocean currents. The source of the lindane is unknown but most likely reflects past uses other than seed treatment. Lindane is the gamma isomer of hexachlorocyclohexane (HCH) and is also known as gamma isomer of benzene hexachloride (BHC). Technical HCH contained the alpha, beta, delta, and gamma isomers but was banned in the United States in the 1970s. The composition of technical HCH varied widely, but often the alpha isomer was the predominant isomer. Lindane (gamma isomer of HCH) remains registered in the U.S. as a seed treatment only.

The Indigenous Peoples of the Arctic region of the U.S. (Alaska) rely heavily on subsistence diets as their food source. Thus, it is appropriate for the Agency to perform a supplementary dietary risk and exposure assessment to assess the risk to the Indigenous People from worldwide use and manufacture of lindane.

EXECUTIVE SUMMARY:

Using average subsistence food intake rates and total HCH residues from moose, surf scoter, lake trout, and blueberries results in an exposure of 0.006553 mg/day. Thus dividing this exposure by 70 kg (weight of adult) would result in an exposure for the Indigenous People to lindane of 0.00009 mg/kg bw/day which is 6 % cPAD and below HED's level of concern (cPAD = 0.0016 mg/kg body weight/day). Even using the adult intake amounts and dividing the 0.006553 mg/day by 10 kg (weight of child) amounts to an exposure to lindane of 0.0007 mg/kg/day which is 44 % cPAD and is below HED's level of concern.

DETAILED CONSIDERATIONS:

The chronic population adjusted dose (cPAD) for lindane is 0.0016 mg/kg/day. The cPAD is the chronic RfD divided by the FQPA Safety Factor which is 0.0047 mg/kg/day divided by a safety factor of 3 yielding a cPAD of 0.0016 mg/kg/day. The chronic endpoint and dose is listed in Table 1 below.

The Agency used the subsistence food intake rates from an article by S. Harris and B. Harper entitled "A Native American Exposure Scenario"¹. The authors used survey information from 35 tribal members of the Confederated Tribes of the Umatilla Indian Reservation, located in N.E. Oregon in the Columbia River Basin. They also supplemented the survey information with open literature information. They found an adult's average subsistence intake rates were 540 grams of fish, 250 grams of game meat, and 44 grams of fowl meat per day. This report did not survey intake rates for children. The Division of Subsistence of the Alaska Department of Fish and Game² found that the highest harvest of subsistence plants in 19 communities which were surveyed amounted to 30 grams per day. In the Yukon First Nations' Dietary Assessment³ survey results showed that males consumed approximately 150 grams of moose fat per day. Surveys in Western Canada have found that tribal communities consume less fish and slightly more game meat than found in this Oregon study. Variability in intake amounts have been shown between tribal communities within Western Canada. It is therefore likely that there would be variability in intake rates between tribal communities in Alaska depending on the availability of fish and game meat. The Agency coupled this with data which was contained in a literature review titled "Dietary Exposure to Chemical Contaminants from Traditional Food among Adult Dene/Metis in the Western Northwest Territories, Canada".⁴ This study summarized the analytical results of 31 different published and unpublished reports on contaminant levels in the traditional food of Denendeh (part of the Northwest Territories). The report gave analytical results of the samples for total hexachlorocyclohexane (HCH) and not the individual isomers. Using this value would overestimate the risk estimate by including other isomers of HCH in addition to lindane which is the gamma isomer. The other isomers of HCH may be environmental concentrations resulting from previous use of technical HCH.

The literature review included analytical results for total HCH in moose flesh, surf scoter flesh, and lake trout flesh along with numerous other traditional foods. The report listed a mean residue value of 2.0 ng/g of total HCH for moose flesh. Multiplying 2.0 ng/g by 250 grams of game meat consumed per day would result in an exposure of 500 ng of HCH per day for an adult. The report also included analytical results for surf scoter flesh with a mean residue value of 1.0 ng/g of HCH. Multiplying this residue by 44 grams of fowl meat consumed per day would result in an exposure of 44 ng of total HCH per day for an adult. The report included analytical results for lake trout flesh with a mean residue value of 10 ng/g of total HCH. Multiplying the mean residue of 10 ng/g by 540 grams of fish consumed per day would result in an exposure of 5400 ng of total HCH per day for an adult. The report included analytical results for raw blueberries with a mean residue value of 0.3 ng/g of total HCH. Multiplying this residue by 30 grams of subsistence plants consumed per day would result in an exposure of 9 ng of total HCH per day for an adult. The report included analytical results for caribou fat with the highest residue value of 4 ng/g of total HCH. Multiplying this residue by 150 grams of moose fat consumed per day would result in an exposure of 600 ng of total HCH per day for an adult.

Summing the exposures from the five subsistence food sources amounts to an exposure to total HCH of 6553 ng/day. When converted to mg/day this exposure becomes 0.006553 mg/day. This value must be divided by the weight of an adult in kilograms for comparison to the chronic Population Adjusted Dose (cPAD). The units of the cPAD are mg/kg body weight/day. The cPAD for lindane is 0.0016 mg/kg body weight/day. Dividing 0.006553 mg/day by 70 kg would result in an exposure of 0.00009 mg/kg/day. Comparing this exposure to the lindane cPAD of 0.0016 mg/kg body weight/day reveals that the exposure of the Indigenous People to lindane is 6 % cPAD and thus, would be below HED's level of concern. Even using the adult intake amounts and dividing the 0.006553 mg/day by 10 kg (weight of child) would amount to 0.0007 mg/kg/day which is 44 % cPAD and still below HED's level of concern.

Table 1. Lindane: Toxicological Doses and Endpoints for Dietary Risk Assessment.

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT	STUDY TYPE/ MRID
Chronic Dietary	NOAEL=10 ppm (0.47 mg/kg/day)	LOAEL is 100 ppm (4.81 mg/kg/day) periacinar hepatocyte hypertrophy, increased liver/spleen weight, and increased platelets	Chronic Feeding and Carcinogenicity in Rats
	UF = 100		41094101
	FQPA = 3X		41853701
	42891201		
	Chronic RfD = 0.0047 mg/kg/day Chronic Population Adjusted Dose (cPAD) = 0.0016 mg/kg/day		

cPAD = RfD/FQPA Safety Factor.

Literature cited:

¹S. Harris and B. Harper. A Native American Exposure Scenario. 1997. Risk Analysis, Vol. 17. No. 6. pp. 789-795.

²J. Fall. The Division of Subsistence of the Alaska Department of Fish and Game: An Overview of Its Research Program and Findings: 1980-1990. 1990. Arctic Anthropology, Vol. 27. Pp. 68-92.

³O. Receveur, N. Kassi, H. Chan, P. Berti, and H. Huhnlein. Yukon First Nations' Assessment of Dietary Benefit/Risk. 1998. Centre for Indigenous Peoples' Nutrition and Environment, Macdonald Campus of McGill University, Ste-Anne-de-Bellevue, Quebec.

⁴P. Berti, O. Receveur, H. Chan, and H. Kuhnlein. Dietary Exposure to Chemical Contaminants from Traditional Food among Adult Dene/Metis in the Western Northwest Territories, Canada. 1998. Environmental Research, Section A, Vol. 76. pp. 131-142.

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